

SPANISH RESIDENTIAL ELECTRICITY DEMAND USING AGGREGATE DATA

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Overview

From 1990 to 2008, Spanish residential electricity demand accumulated a growth of 32%, becoming the largest and most dynamic electricity consumption sector. The main reasons for this trend have been (i) an important population increase and an even larger increase in the number of new houses; (ii) a decreasing household size; (iii) a convergence with the rest of Europe in household equipment; and (iv) a long lasting policy of low tariffs. Additionally, Spanish electricity demand is significantly related to climatic factors. A considerable portion (32%) of the electricity consumed in Spain is produced in coal and gas power plants. As a consequence, a systematic failure of Spain to comply with the Kyoto Protocol commitments has been observed during recent years. Therefore, climate change, security of supply, and an electric power system highly based on (external) fossil fuels have made the encouragement of an efficient use of electricity by residential consumers a main objective of Spanish energy policy. In order to design policy instruments that influence electricity demand, it is crucial to have information on price and income elasticities and to identify the determinants of this demand. Despite the extensive literature published on modelling the residential demand for electricity and examining its determinants, there are only two main contributions focusing on the demand for residential electricity in Spain: Labandeira et al. (2006) and Labandeira et al. (2011). Both works use household disaggregate data and find very different values for short-run price elasticities. Therefore, it seems clear that further research must be carried out. The objectives of this paper are the following: (i) provide new empirical evidence for Spanish residential electricity demand on the values of the short and long run price and income elasticities; (ii) analyse the impact of climate variables on electricity consumption using different definitions for computation of them.

Methods

In contrast to the previous papers focused on Spain, this paper presents an empirical analysis on the residential demand for electricity which has been performed using aggregate panel data at the province level for 47 Spanish provinces for the period from 2000 to 2008. For this purpose, we estimated a log-log demand equation for electricity consumption using a dynamic partial adjustment approach:

$$\ln E_{it} = \beta_P + \beta_{EP} \ln E_{it-1} + \beta_{PP} \ln PE_{it} + \beta_Y \ln Y_{it} + \beta_{POP} \ln POP_{it} + \beta_{HS} \ln HS_{it} \\ + \beta_{GAS} GAS_{it} + \beta_{HDD} \ln HDD_{it} + \beta_{CDD} \ln CDD_{it} + \beta_{DT} DT_t + \varepsilon_{it}$$

where E_{it} is aggregate electricity consumption; E_{it-1} is the aggregate electricity consumption in period $t-1$; Y_{it} is real disposable income of the household sector; PE_{it} is the real average price of electricity; HS_{it} is household size; POP_{it} is population; GAS_{it} is gas penetration rate; HDD_{it} and CDD_{it} are, respectively, the heating degree days and the cooling degree days; DT is a series of time dummy variables and, ε_{it} is

the disturbance term. This dynamic demand function has been estimated using OLS, a fixed effect model, and a GMM estimator proposed by Blundell and Bond (1998).

Results

In general, the results show that socioeconomic variables such as population and household size, as well as the penetration of gas, seem to have an important influence on Spanish residential demand for electricity. The estimated short and long-run own price elasticities are, as expected, negative, but lower than 1. The empirical results show also relatively low (positive) short and long run income elasticities. Furthermore, weather variables have a significant impact on electricity demand.

Conclusions

According to the results obtained, one could expect that an increase in electricity prices will have a modest impact on the residential electricity demand. Therefore, it is clear that in order to limit the growth rate of electricity consumption policy makers should introduce complementary policies such as higher energy efficiency standards for electrical appliances.

References

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